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P-003-001651 Seat No. _____

B. Sc. (Sem. VI) (CBCS) Examination

March / April - 2020

Design of Exp. & Sampling Tech.

(Old Course)

Faculty Code : 003
Subject Code : 001651

Time : $2\frac{1}{2}$ Hours] [Total Marks : **70**

1 Fill in the blanks : (Each 1 Mark) **20**

(1) Systematic influences likely to occur in an experiment can be removed through _____.

(2) Greater homogeneity within the block in an experiment is better maintained through _____.

(3) Among k treatments, there can at most be _____ orthogonal contrasts.

(4) The design where only replication and randomization are used is _____.

(5) If there are t treatments and m blocks in a randomized block design, the error degrees of freedom in ANOVA table be _____.

(6) An experiment involving two or more factors at various levels is called a _____ experiment.

(7) In factorial experiments, one estimates _____ and _____ effects.

(8) In a 2^n factorial, the higher level of a factor is known as _____

(9) Preferably _____ interaction is chosen for confounding.

(10) The method of confounding to reduce block size is applicable only for _____ experiment.

(11) All sampling units are present in _____ population.

(12) A function for estimating a parameter is called as _____.

(13) Number of samples of size n that can be drawn out of N population units through simple random sampling without replacement is _____.

(14) Stratified sampling is appropriate when population is _____.

(15) Optimum allocation is also known as _____ allocation.
(16) Standard error of mean in terms of S^2 is _____.
(17) Attaining maximum efficiency in estimating for a fixed cost is apart of principle of _____.
(18) Stratified sampling is not preferred when the population is _____.
(19) The main disadvantage of systematic sampling is that _____ formula for estimating the standard error of sample mean is available.
(20) When the population size N is not divisible by the sample size n, _____ systematic sampling appropriate.

2 (A) Give the answer : (Any **Three**) **6**

(1) Define Design of Experiment
(2) Write ANOVA table for one way classification.
(3) Define Experimental error
(4) What is meant by sampling frame?
(5) Prove that $E(\bar{y}) = \bar{Y}$
(6) Obtain variance of simple random sample mean if $N = 1000, n = 100, s^2 = 480$

(B) Give the answer : (Any **Three**) **9**

(1) Write the set of orthogonal contrasts for main effect and interaction in 2^3 – experiment
(2) Explain types of confounding and also define its difference.
(3) Prove that $E(s^2) = S^2$
(4) Prove that $Var(\bar{y}_n)_{ran} > V(\bar{y}_{sys})$ if and only if $S^2{}_{wsys} > S^2$
(5) Prove that if $N \to \infty$ then $V(\bar{y}_{st}) = \dfrac{\sum_{h=1}^{L} w^2 h S^2 h}{n_h}$

where $W_h = \dfrac{N_h}{N}$.

(6) The three samples below have been obtained from the normal population with equal variance. Test the hypothesis at 5% level that the population means are equal. $\left[F_{(0.05;2,11)} = 4.26\right]$

x_1	6	8	5	3
x_2	7	9	10	8
x_3	3	5	6	8

(C) Give the answer : (Any **Two**) **10**

(1) Explain estimation of one missing plot in R.B.D.

(2) Explain analysis of LSD

(3) Explain basic principle of design of experiment

(4) Prove that $V(\bar{y}_{st}) \leq V(\bar{y}_{sys}) \leq V(\bar{y}_n)_{ran}$ if population consists of a linear trend

(5) Prove that $V(\bar{y}_{sys}) = \frac{N-1}{N}\frac{S^2}{n}\left[1+(n-1)\rho\right]$

3 (A) Give the answer : (Any **Three**) **6**

(1) Define Simple Random Sampling

(2) In what situations sampling is invetible?

(3) Define : Replication, Precision

(4) Define Symmetrical factorial experiment

(5) Write the Yate's method for a 2^2–experiment

(6) It is known that the population standard deviation in waiting time for LPG gas cylinder in Rajkot is 16 days. How large a sample should be chosen to be 95% confident, the waiting time is within 8 days of true average.

(B) Give the answer : (Any **Three**) **9**

(1) Explain layout of design of Latin Square Design

(2) Yate's Method for 2^3–experiment

(3) Prove that $V(\bar{y}_{sys}) = \frac{N-1}{N}S^2 - \frac{N-k}{N}S^2_{wys}$

(4) Prove that : (i) $E(\bar{y}_{st}) = \bar{Y}$

(ii) $V(\bar{y}_{st}) = \frac{1}{N^2}\left\{\sum_{h=1}^{L} N_h \frac{N_h(N_h - n_h)s^2h}{n_h}\right\}$

(5) The following data represent the number of units of a product produced by 3 different workers using different types of machines. $\left[F_{(0.05;9,3)} = 8.81\right]$

	Workers			
Machines	*A*	*B*	*C*	*D*
W	10	15	7	12
X	12	20	10	16
Y	14	7	9	10
Z	8	16	20	8

Test the hypothesis at 5% level (i) whether the mean productivity is the same for the different machines types, and (ii) wheter the three workers differ with respect to mean productivity.

(6) A population is divided in three strata. The information regarding them is as follows :

Stratum	N_h	S_h
1	100	4
2	200	5
3	200	3

Find $V(\bar{y}_{st})$ under optimum allocation 10% stratified sample is to be taken.

(C) Give the answer : (Any **Two**) **10**

(1) Explain estimation of one missing plot in L.S.D.

(2) Efficiency L.S.D. over in R.B.D.

(3) Prove that $V(\bar{y}_{ran}) \geq V(\bar{y}_{st})_{prop} \geq V(\bar{y}_{st})_{opt}$

(4) Prove that $V(\bar{y}_{st})$ is minimum for fixed total size of the sample n and $n_i = \dfrac{nN_iS_i}{\sum_{i=1}^{k} N_iS_i}$

(5) For studying the characteristics the observation of a population are 1,2,3,4. How many random samples of size 2, without replacement can be taken from it? Making a list of all the samples verify the following results :

(i) $E(\bar{y}) = \bar{Y}$

(ii) $V(\bar{y}) = \dfrac{N-n}{n}\dfrac{S^2}{n}$ (iii) $E(s^2) = S^2$
